

## II. Remarks

Claims 1-3 are pending in this case. Of these, claims 1-3 stand rejected under 35 U.S.C. Section 103(a) as being unpatentably obvious over Nachod et al., U.S. Pat. No. 2,475,752, in view of Babor, Basic College Chemistry, and Felder et al., Elementary Principles of Chemical Processes, and, optionally, in view of Perry's Chemical Engineers' Handbook. More particularly, it is the *examiner's* position in respect of claim 1 that Nachod et al. teach all aspects claimed with the exception of the sulfuric acid and alkali metal chloride being fed in a molar ratio of approximately 1 to 1, and the ratio of kiln length to diameter.<sup>1</sup> As to these deficiencies in the primary reference, the examiner notes that Babor teaches "that for any reaction, the velocity is equal to the velocity constant for that reaction multiplied by the concentrations of the reacting substances, each concentration being raised to that power indicated by the coefficient of the substance in the equation for the reaction or to state it another way: the velocity is proportional to the product of the concentrations of the reacting substances...." Official Action, p. 4. From this the examiner reasons that "it would have been obvious to increase the concentration of either reactants to increase the reaction rate." *Id.* As to the matter of increasing one or the other of sulfuric acid or the alkali metal chloride, it is the examiner's contention that an increase in sulfuric acid in the process of Nachod et al. would have been obvious since "if sodium chloride was used in excess, the excess sodium chloride remained would be harder to be separated from the solid sodium sulfate product." *Id.* at p. 5. For the reasons particularized below, Applicant respectfully disagrees.

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<sup>1</sup>Applicant notes that the ratio of kiln length to shell diameter, though present in the parent case, were *never* presented in the instant application. Likewise, the claims do not recite recycling unreacted sulfuric acid, though Felder continues to be applied. Applicant hopes that the examiner's rejection of such unclaimed subject matter does not reflect a less than thorough review and examination of the pending case.

A *prima facie* case of obviousness requires, *inter alia*, that the prior art references teach or suggest all of the claim limitations, as well as the existence of some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. See M.P.E.P. § 2143. Motivation is particularly important: “Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art.” *Id.* at § 2143.01 (*citing In re Fine*, 837 F.2d 1071, 5 U.S.P.Q. 2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 U.S.P.Q. 2d 1941 (Fed. Cir. 1992)). That references *can* be combined or modified does not alone render the resultant combination obvious; the prior art must suggest it. See *In re Mills*, 916 F.2d 680, 16 U.S.P.Q. 2d 1430 (Fed. Cir. 1990). As the court remarked in *In re Linter*: “In determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the proposed substitution, combination, or other modification.” 458 F.2d 1013, 173 U.S.P.Q. 560, 562 (CCPA 1972). Applicant respectfully submits that the art of record, as applied by the examiner, or in any other way, does not create a *prima facie* case of obviousness.

In the first instance, Applicant disagrees with the examiner as to the teaching of the Nachod et al. reference, at least because Nachod et al. (1) do not teach a continuous process, and (2) further fail to comprehend the intermediate reactions claimed as part of Applicant’s invention.

That Nachod et al. teach a batch--as opposed to a continuous--process, is manifest by the

specification thereof, wherein it is expressly recited that the “[s]odium chloride was fed to the *charging* end of a substantially horizontal furnace 11 by means of a *charge* chute 13,” while the “[s]ulfuric acid...was simultaneously fed to the furnace by separate conveyor (conduit) means 14 communicating with the same *charging* end of the furnace....” Col. 3, lines 45-56 (*emphasis added*). The foregoing language clearly contemplates the intermittent introduction of discrete quantities of reactants and, consequently, a batch process.

In further evidence of the batch-wise nature of the Nachod et al. process, that reference specifies “a system of cooperating elements in which there are a number of interconnecting *cyclic* steps resulting in an overall unified *cyclic* operation....” Col. 5, lines 67-71 (*emphasis added*). Disclosure of a cyclic operation –i.e., one that comprises a recurring round of operations or events which repeat themselves regularly and in the same order, *see Webster’s New American Dictionary*, p. 129 (1995)(definition of a “cycle”)-- likewise implicates a batch process.

Nor, in the face of the foregoing evidence, is there anything in the teaching of Nachod et al. to suggest that other than a batch process is contemplated.

Turning to the claimed intermediate reactions of Applicant’s invention, the examiner incorrectly asserts that these same intermediate reactions are inherent in the process of Nachod et al. This contention is premised upon the following arguments:

1. When the formed sulfuric acid ( $H_2SO_4$ ) is cancelled from among the products of Applicant’s reaction, and a corresponding sulfuric acid is cancelled from among the reactants, the net reactions as between Nachod and the instant invention – i.e.,  $H_2SO_4 + 2 NaCl \rightarrow 2 HCl + Na_2SO_4$  – are the same. Therefore, the contention goes, the intermediate reactions must be the same. Official Action, p. 3.
2. Even in the absence of an additional mole of sulfuric acid, “sodium hydrogen

sulfate ( $\text{NaHSO}_4$ ) would still be formed, and this in turn will form  $\text{Na}_2\text{S}_2\text{O}_7$ , then  $\text{Na}_2\text{SO}_4$  and  $\text{SO}_3$  and the formed  $\text{SO}_3$  will react with water to form sulfuric acid and the formed sulfuric acid will then involve in the reaction  $[2\text{H}_2\text{SO}_4 + 2\text{NaCl} \rightarrow 2\text{NaHSO}_4 + 2\text{HCl}]$ .” *Id.*, p. 4.

“Inherency...may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.”

Hansgirg v. Kemmer, 40 USPQ 665, 667 (CCPA 1939). Yet, in this instance, the examiner’s arguments are simply too tenuous and probabilistic to make a case for inherency; the disclosure of the primary reference is insufficient to show that the instantly claimed intermediate reactions are “the natural result” flowing from the reaction of a sulfuric acid and sodium chloride in a 1 to 2 mole ratio. Indeed, both arguments necessarily fail when the fallacy of the second is considered in more detail.

In a reaction involving only a single mole of sulfuric acid, only a single mole of  $\text{NaHSO}_4$  would be produced ( $\text{H}_2\text{SO}_4 + 2\text{NaCl} \not\rightarrow 2\text{NaHSO}_4 + 2\text{HCl}$  does not balance!). Consequently, it is by no means clear, despite the examiner’s contrary arguments, that a single mole of  $\text{NaHSO}_4$  would decompose to produce sodium pyrosulfate ( $\text{Na}_2\text{S}_2\text{O}_7$ ), or that such would, in turn, decompose to produce sodium sulfate and sulfur trioxide.

Confirming the error in the examiner’s reasoning is the fact that Nachod et al. nowhere disclose the production of sulfur trioxide. On the contrary, Nachod et al. expressly state that “[t]he furnace gas on the basis of one hour of flow, contained 1390 lbs. of HCl, 370 lbs. of  $\text{H}_2\text{O}$ , and 12,700 lbs. of combustion gas (carbon dioxide, nitrogen, oxygen, etc.).” Col. 3, line 74-col.

4, line 2. Likewise, the nature of the effluent is particularized in claim 1 as comprising "hydrogen chloride, water vapor, and inert gaseous diluents...."

Respectfully, Applicant submits that the presence of sulfuric acid and an alkali metal chloride in a molar ratio of approximately one to one, as instantly claimed, defines a different reaction mechanism than that of the Nachod et al. process, notwithstanding the fact that the *net* reactions (i.e., the *production* of HCl and Na<sub>2</sub>SO<sub>4</sub> from an alkali metal chloride and sulfuric acid) may be the same. *See* Declaration of Henry C. Griffin (attached).

Even assuming, *arguendo*, that Nachod et al. teach all that the examiner contends, the Babor reference fails to lend itself to a *prima facie* case of obviousness, both for a lack of motivation and the inadequacy of its teachings.

Respecting the propriety of combining Babor and Nachod et al., the examiner contends that the rate law would have motivated one of ordinary skill to have increased the concentration of either sulfuric acid or sodium chloride in the Nachod et al. process. Selection of excess sulfuric acid, according to the examiner, would have been motivated by the "fact" that an excess of sodium chloride would have resulted in the presence of excess sodium chloride in the solid sulfate product, making separation of these compound problematic. This argument fails for at least three reasons.

First, there is no evidence of record suggesting that an excess of sodium chloride would have manifest itself in the sodium sulfate product, thus presenting a separation problem sufficient to dissuade one of ordinary skill in the art from using an excess of sodium chloride versus sulfuric acid. There is, moreover, no suggestion in Nachod et al. that anything is done with the sodium sulfate product after it is discharged from the furnace. Consequently, Applicant fails to understand how the issue of separation would have even presented itself to one of ordinary skill

in the art as a problem militating in favor of increasing the sulfuric acid concentration.

Second, the rate law is an empirical observation which does "not necessarily fit the simple stoichiometry of the balanced chemical equation but may be the consequence of a more complex underlying molecular reaction mechanism." Whittaker et al., Physical Chemistry, p. 126 (BIOS Scientific Publishers, Ltd. 2000)(attached). In this light, the facts that Babor (1) does *not* pertain to anything more relevant to the claimed invention than the nature of chemical reactions generally, (2) does *not* provide any identification of critical parameters relative to the preparation of hydrogen chloride from sodium chloride and sulfuric acid, and (3) *fails* to offer even general direction as to how the question of reaction velocity generally may be applied in any meaningful way to the production of hydrogen chloride necessarily reduce that reference to an isolated teaching of general chemistry whose only relevance or application to the claimed invention comes from the examiner's hindsight combination of references. It cannot, therefore, be asserted that one of ordinary skill in the art would have expected an increase in the concentration of either sulfuric acid or sodium chloride, especially to the instantly claimed ratio of 1 to 1, to have inevitably produced an increase in the rate of reaction for the Nachod et al. process.

Finally, and as attested to by Henry C. Griffin, tenured professor of chemistry at the University fo Michigan, the physical nature of the reaction in Nachod et al. does not suggest to one of ordinary skill that the increase in the mole ratio of one or the other of the reactants would increase the rate of reaction. As Professor Griffin states:

"This conclusion is premised upon the following: First, the reactions among the reactants in contact in the process of Nachod et al. are substantially instantaneous, such that no increased reaction rate would be realized by the addition of greater amounts of sulfuric acid. Second, the reactant feed of Nachod et al. is heterogenous, comprising *fluid* sulfuric acid and *solid* alkali chloride. Given that the surface area of the solid metal chloride is unchanged, the addition of greater amounts of sulfuric acid would not be expected to alter the rate of reaction."

Declaration of Henry C. Griffin, ¶ 4 (attached)(*emphasis original*).

In view of the foregoing, Applicant submits that the rejection of the remaining claims are rendered moot. However, Applicant further submits that the art of record, taken alone or in any permissible combination, fails to render obvious the invention of these claims, and if any of the claims should continue to be rejected, Applicant reserves the right to argue such rejections and/or place the claims in allowable form, as appropriate.

Relative to the examiner's stated confusion concerning the relationship between the instant application and priority applications Serial No. 08/886,383, filed July 1, 1997, and Serial No. 09/413,226, filed October 13, 1998, Applicant reiterates the cross-reference data as stated in the specification; namely, that the instant application is a *continuation-in-part* of application Serial No. 09/413,226, which application is, in turn, a *continuation* of application Serial No. 08/886,383.

**III. Conclusion**

In view of the foregoing, Applicant respectfully submits that the instant application is in condition for immediate allowance. Of course, the examiner is invited to contact Applicant's undersigned counsel at (734) 662-0270 if he should have any questions respecting this paper.

Respectfully submitted,



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Dated: October 22, 2003